

Lawrence Livermore National Laboratory

Industry Partnering and Technology Transfer

Through a vigorous industrial partnering effort, science and technology breakthroughs made in the course of Lawrence Livermore National Laboratory's (LLNL) mission research are transformed into products and capabilities that create new industries and help grow the U.S. economy.

In today's highly competitive marketplace, rapid creation and commercialization of scientific advances and innovative technologies are key to the continued prosperity of the United States. Scientists and engineers at the Laboratory have achieved numerous science and technology breakthroughs that have led to new industries, spurred economic growth and benefited quality of life.

The connection of scientific research and technology development to a strong and vibrant economy is widely recognized. The federal government is the primary funding source for basic scientific research in the United States, and congressional legislation directs the national laboratories to actively seek opportunities for transferring technologies developed under federal funding to the private sector. LLNL has embraced this charge and has an impressive track record of creating successful commercial partnerships and entrepreneurial ventures based on Laboratory-developed technologies.

Leader in Technology Innovation and Technology Transfer

LLNL has seen dramatic growth of its technology transfer activities over the past several years, including a sevenfold increase in the licensing of patents to industry. Each year, LLNL inventors file 130-160 records of invention and are awarded 60-75 patents.

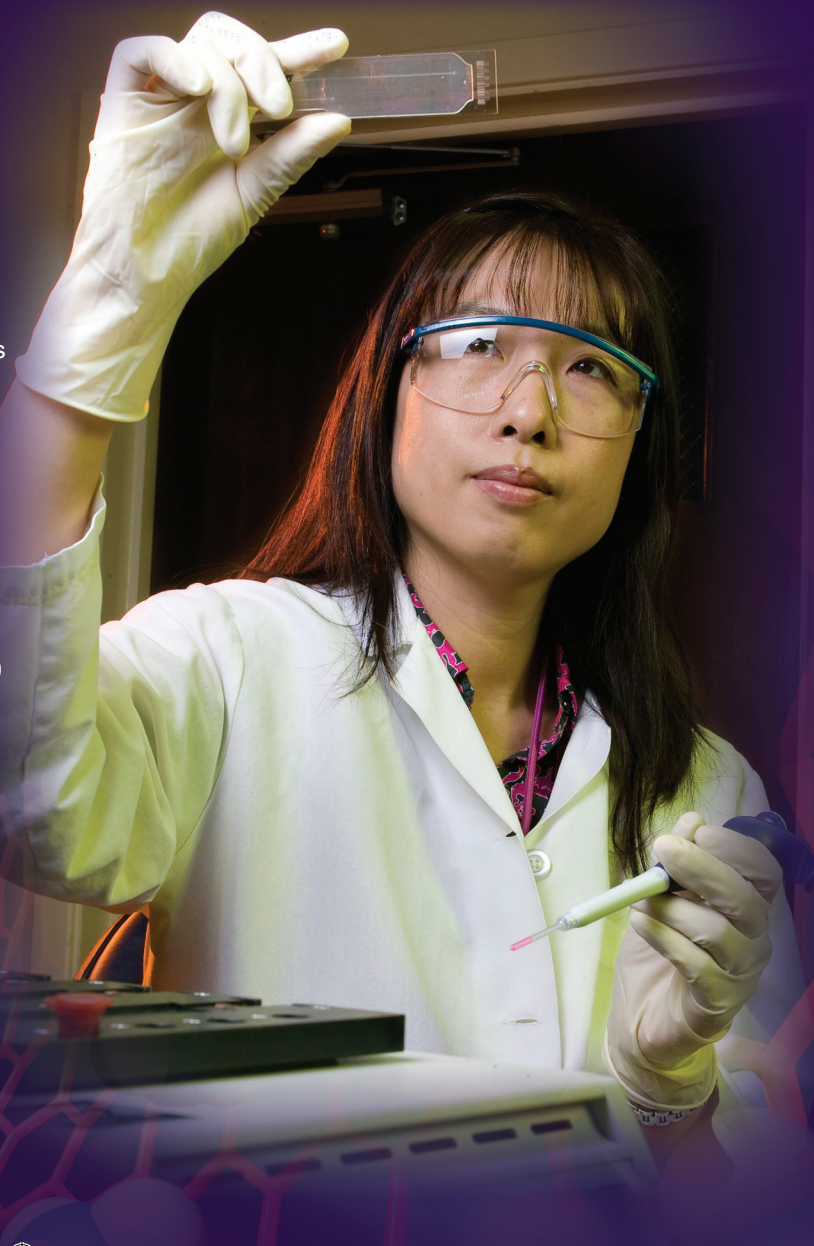
Typically, up to a dozen new cooperative research and development agreements (CRADAs) are executed every year, along with 25 new commercial licenses for Laboratory-developed technologies and software. LLNL has active commercial licenses with more than 100 companies. Licensing and royalty income in recent years has topped \$10 million, representing more than \$400 million in annual sales of products based on LLNL technologies.

Laboratory-licensed technologies have enabled the launch of numerous new businesses, including energy-related, medical technology, detection and sensing, and advanced manufacturing enterprises. In the last two years, 14 new ventures were granted

options or licenses to LLNL technologies for the launch of new businesses.

LLNL technologies regularly receive R&D 100 awards, bestowed annually by R&D Magazine on the 100 most innovative ideas with potential for broad impact, revolutionary change and marketplace success. Since 1978, the Laboratory has received 148 of these "Oscars of Invention."

The Lawrence Livermore Microbial Detection Array allows medical professionals, law enforcement and others to detect within 24 hours pathogens on a priority screening list as well as other already-sequenced bacteria and viruses in a sample.



Technology Transfer Highlights

LLNL science and technology breakthroughs transferred to industry have created billions of dollars in cost savings and market expansion, and current industry partnerships will help position the nation for continued leadership in the 21st century global economy.

Notable success stories include:

- **DYNA structural response code:** Allowed the auto industry to ensure vehicle safety with minimum full-scale crash testing.
- **Chromosome painting:** Enabled the field of molecular diagnostics and study of the human genome.
- **Rapid DNA analysis:** Took the PCR technique for DNA amplification out of the lab and into commercial applications for health care and biosecurity.
- **Electronic design automation:** Revolutionized the design of integrated circuits with automated computer-aided design.

Current initiatives promise similarly transformative changes for the future. For example:

- **Electromechanical battery:** Highly efficient solution for alternative energy systems without the need for electrical power.
- **Carbon capture and sequestration innovations:** Possibility for leadership in a major new zero-carbon industry.
- **Additive manufacturing for engineered materials:** Engineering models, instruments and techniques that can deliver 3-D microstructures with previously unobtainable properties.
- **Compact proton accelerator:** Potential to make the most advanced form of radiation therapy for cancer treatment readily available in hospital settings.
- **In-vivo tissue imaging:** Enables disease diagnosis in living tissue, without the need for biopsy.
- **Flexible neural implants:** Biocompatible, fully implantable, miniaturized devices with potential to treat numerous neural disorders (e.g., macular degeneration, Parkinson's disease).

Membranes made from Laboratory-developed carbon nanotube technology can be used to rapidly and cheaply desalinate water.

Mechanisms for Partnering

The LLNL Industrial Partnerships Office is the conduit through which the Laboratory connects industry partners with Livermore-developed technologies. A number of mechanisms are available by which LLNL can partner with and transfer technology to the private sector. In addition to technology licenses, work for others agreements and cooperative research and development agreements, the Laboratory offers several unique partnering arrangements. For example, LLNL works with university entrepreneurship centers and business schools, making technologies prime for business development available for students to use in business plan competitions. An "entrepreneurs in readiness" program matches entrepreneurs searching for new startup opportunities and who understand market needs with LLNL technologies ready for commercialization. Other mechanisms for transferring technology out of the Laboratory include partnerships with patent brokerage firms, angel investor networks, a financial advisory company, Fortune 100 company technology scouts, and venture capital divisions. In 2011, LLNL opened the High Performance Computing Innovation Center for the express purpose of making high performance computing resources and expertise available to industry as a way to boost U.S. competitiveness in the global marketplace.

For more information, contact the LLNL Public Affairs Office, P.O. Box 808, Mail Stop L-3, Livermore, California 94551 (925-422-4599) or visit our website at www.llnl.gov.

LLNL is managed by Lawrence Livermore National Security, LLC, for the U.S. Department of Energy, National Nuclear Security Administration, under Contract DE-AC52-07NA27344.

LLNL-BR-432893



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